PATENT ABSTRACTS OF JAPAN

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(54) **X-RAY CT APPARATUS**

(57)Abstract:

PROBLEM TO BE SOLVED: To largely improve inspection efficiency by an X-ray CT apparatus of one bulb.

SOLUTION: This X-ray CT apparatus reconstitutes a CT image of a subject on the basis of photographing data provided by scanning the subject. This X-ray CT apparatus has a first photographing system having a first X-ray source for exposing an X-ray and a first detector for detecting the X-ray passed through the subject, a second photographing system having a second X-ray source for exposing the X-ray and a second detector for detecting the X-ray passed through the subject, and a control means for scanning the same position of the object, by making energy of the X-ray irradiated from a first X-ray tube of the first photographing system, different from energy of the X-ray irradiated

from a second X-ray tube of the second photographing system.

LEGAL STATUS

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[Date of final disposal for application]	
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[Date of registration]	
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

CLAIMS

[Claim(s)]

[Claim 1]

X which reconfigurates CT image of said analyte based on the projection data which scanned analyte and was obtained

In a line CT scanner,

The 1st ** for detecting the X-ray which penetrated the 1st X line source and said analyte which carries out exposure of the X-ray

The 1st photography system which has ****,

The 2nd ** for detecting the X-ray which penetrated the 2nd X line source and said analyte which carries out exposure of the X-ray

The 2nd photography system which has ****,

The energy of the X-ray irradiated from the 1st X-ray tube of said 1st photography system, and said 2nd photography system

The energy of the X-ray irradiated from the X-ray tube of **** 2 is changed, and it is the same location of said photographic subject.

The X-ray CT scanner characterized by having the control means made to scan.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[Field of the Invention]

[0001]

This invention is Seki to the X-ray CT scanner which has an X-ray detector corresponding to two or more X line source and X line sources each.

It carries out.

[Background of the Invention]

[0002]

While development of medical diagnostic equipment is furthered in recent years, the tomogram for the part of the arbitration of analyte is photoed.

Many CT scanners have come to be used. Moreover, it is drawing about shortening of the photography of a tomogram in these days.

For a ** reason, the perimeter of analyte is scanned spirally and it is interpolation processing about the data of each slice location.

Practical use is presented with the helical scan approach which computes and reconfigurates a slice image based on this.

**.

[0003]

For the conventional helical scan CT scanner, as shown in drawing 9 A, B, and C, one bulb 71 is the body.

Continuous [in accordance with an orbit 76] in the surroundings of the patient 70 on the berth 75 movable to shaft orientations (analyte)

It was alike, and it rotated and the beam 72 was performing the spiral scan.

[Description of the Invention]

[Problem(s) to be Solved by the Invention]

[0004]

However, it is in the conventional helical scan CT scanner,

(1) Since the number of bulbs is one, two or more scans in a certain time of day cannot be performed.

(2) It can scan only on one scan condition at once.

(3) If the heat capacity of optical system fills, it must wait until it cools down. Moreover, failure

When it carries out, time is taken in exchange of alternative optical system.

(4) Although it is necessary to scan for a short time before a contrast medium goes away, there is only one bulb.

It comes out and cannot scan in a short time.

(5) Since there is only one bulb, the large range cannot be scanned by fixed time amount.

There was un-arranging [to say].

[0005]

It is made in view of above-mentioned un-arranging, and this invention is a patient throughput from the X-ray CT scanner of one bulb.

It aims at making it improve.

[Means for Solving the Problem]

[0006]

It is **** to the projection data which this invention scanned analyte in order to attain the above-mentioned purpose, and was obtained.

1st X line source which carries out exposure of the X-ray in the X-ray CT scanner which comes and reconfigurates CT image of said analyte

And the 1st photography system which has the 1st detector for detecting the X-ray which penetrated said analyte,

2nd detection for detecting the X-ray which penetrated the 2nd X line source and said analyte which carries out exposure of the X-ray

Energy of the X-ray irradiated from the 1st X-ray tube of the 2nd photography system which has a vessel, and said 1st photography system

RUGI and the energy of the X-ray irradiated from the 2nd X-ray tube of said 2nd photography system are changed.

It is characterized by having ** and the control means which makes the same location of said photographic subject scan.

It is.

[Effect of the Invention]

[0007]

According to this invention, the same part is photoed with two or more kinds of X lineal

energies,

Since the image for every energy can be obtained, it is an inspection effect from the CT scanner of one bulb.

A rate can be raised.

[Best Mode of Carrying Out the Invention]

[0008]

Hereafter, the operation gestalt of this invention is explained based on a drawing. Drawing 1 is an X-ray CT scanner concerning this invention.

** -- it is the block diagram showing a rough configuration.

[0009]

The X-ray CT scanner shown in a drawing becomes independent or interlocks at parallel spacing mutually, and is three pivotable tubing.

A ball (X-ray tube) 3-1, 3-2, 3-3, and 3 sets prepared corresponding to each bulb

******** 4-1, 4-2, 4-3, and each ** detected by each detector

3 sets of data collection sections 5-1 made into the form where it collects and is easy to process shadow data, 5-2, and 5-3,

A bulb 3-1, 3-2, 3-3 and a detector 4-1, 4-2, the rotation system that controls rotation of 4-3

The optical-system position control section 8 which controls spacing of the section 7 and a bulb 3-1, 3-2, and 3-3 is included.

It has the stand (part of a broken line) 2.

[0010]

An X-ray CT scanner is an X-ray which controls further X dosage which a bulb 3-1, 3-2, and 3-3 irradiate.

KONTORO which controls a control section 6, and the berth mechanical component 10 and the berth mechanical component 10 which drive a berth 11

It connects with - RA 9, the CC section (CPU) 12, and the CC section 6 through a bus (not shown).

The keyboard 14 as the monitor 13 and scan condition input device to carry out, an internal memory 15, collection DE

It has the magnetic disk 16 which memorizes - TA and image data.

[0011]

The CC section 12 is the X-ray control section 6, the roll control section 7, the optical-system position control section 8, and a conte low.

RA 9 and an image re-component (not shown) are controlled, and it is actuation of the whole X-ray CT scanner of this operation gestalt.

It is superintending. Moreover, the X-ray control section 6 is each X-ray tube (bulb) of every under control of the CC section 12.
An X-ray is controlled. And a certain X-ray tube (for example, X dosage in which a bulb 3-1 carries out exposure and other X)
**** (for example, bulb 3-2) can make X dosage which carries out exposure an amount different, respectively.
.
[0012]
The roll control section 7 is each X-ray tube and/or a detector under control of the CC section 12.
It is the X-ray tube and detection whose groups of an X-ray tube and a detector a roll control is performed and are others by the roll control section 7.
It can rotate now independently with the group of a vessel. The optical-system position control section 8 is a center.
It is the direction of a berth of each X-ray tube and a detector (a patient's (analyte) direction of a body axis) under control of a control section 12.
A motion is controlled. An X-ray tube (bulb) is set to a scan starting position, and, specifically, it is X-ray tube 3.
- the inside of 1, 3-2, and 3-3 -- which X-ray tube -- the direction of a berth (a positive direction or negative direction) -- which
It controls at the rate of how much [extent] it moves. A controller 9 is under control of the CC section 12.
It is alike, the berth mechanical component 10 is made to drive, and a berth 1 is moved in a patient's direction of a body axis.
[0013]
Drawing 2 is the block diagram showing the configuration of each control section shown in drawing 1 , and the CC section 12 is this drawing.
With reference to the shown scan condition list 17, it is based on scan conditions and they are the X-ray control section 6 and a rotation system to a bulb unit.
An instruction (signal) is sent to the section 7, the optical-system position control section 8, and a controller 9, and it is each [these] control.
While controlling the sections 6, 7, 8, and 9, they are each [these] control sections 6, 7, 8, and 9 and a detector 4-1.
Information from 4-2 and 4-3 (for example, the location (spacing) of an angle of rotation and optical system, location **** of a berth)
The amount of radioparency etc. is inputted from the detector of **********, and it is a

feed bar about each control sections 6, 7, 8, and 9.
KKU control is carried out. Each control sections 6, 7, 8, and 9 are based on the feedback control, and are each.
Rotation of the X-ray yield of X line source, a bulb, and a detector and migration, and migration control of a berth are performed. In addition
Rotation and migration of a bulb and a detector are a rotation driving gear (it illustrates) for every group of each bulb and a corresponding detector.
And it does not carry out, it has migration equipment (not shown) and is a driving signal from a roll control 7 and the optical-system control section 8.
It is alike, and it is based, and becomes independent, or interlocks and drives, respectively.
[0014]
The scan condition list 17 is usually memorized by the magnetic disk 16, and X-ray CT scanner 1 starts it.
if carried out, it will read into an internal memory 15 from a magnetic disk 16 -- having -- the CC section 12 -- reference
**** the conditions of the scan condition list 17, and an operator adds and registers. [from a keyboard 14]
It can delete. In this case, the scan condition list 17 is a form as shown in drawing 2 , and is MONI.
Since it is displayed on TA 13, an operator can do the input of scan conditions simply. Moreover, ******
The affair list 17 stores scan conditions according to a bulb, and the number of a proper is beforehand assigned to the bulb.
This number cannot be changed. The sign 17 of drawing 2 shows an example of a scan condition list, and it is the 1st line.
being alike -- the condition graph (for example, this bulb is used .. 1; use of is not done) of the 1st bulb 3-1
.. 2; -- failure .. the value and X filament affair (the X-ray electrical potential difference and current) which show the condition of the bulb 3
Conditions (information), such as movement magnitude of a bulb and the rotation (angle) of a detector, a bulb, and a detector, are stored.
In the 2nd line, are the 3rd bulb 3-3 at the 3rd line of the 2nd bulb 3-2, and it is the n-th line.
The status flag, X filament affair (the X-ray electrical potential difference and current), bulb, and detector of bulb 3-n of the n-th **

Conditions (information), such as movement magnitude of **********, a bulb, and a detector, are stored. To a scan condition list
For example, the CC section is a scan condition squirrel as the X-ray generation source and bulb to depend, and an example of drive actuation of a detector.
The scan conditions of TO to the 1st bulb 3-1 "condition =1;120kV;50mA;1rps;2
mmps" is read and the instruction (signal) based on the scan condition is sent out to each control sections 6, 7, and 8.
Then, the X-ray control section 6 is 120kV and a current about the supply voltage to the X-ray generation source of a bulb 3-1.
An X-ray yield is controlled as 50mA, and a bulb 3-1 and a detector 4-1 rotate the roll control section 7.
It is a drive control signal to a bulb 3-1 and the rotation driving gear of a detector 4-1 so that a rate may be set to 1rps.
Delivery and the optical-system position control section 8 set movement magnitude of a bulb 3-1 and a detector 4-1 to 2mmps(es).
a drive control signal is sent for obtaining at a bulb 3-1 and the migration equipment (not shown) of a detector 4-1.
[0015]
In this operation gestalt, X-ray CT scanner 1 performs a spiral scan to analyte, and it is data.
Reconstruction equipment (not shown) is by this spiral scan to a detector 4-1, 4-2, and 4-3.
The data radical which incorporated and incorporated the obtained location data of the direction of a body axis of the group of data, and a berth 10
It is interpolation data of the slice location of arbitration from ****** interpolation processing (refer to JP,2-211129,A).
It asks for **** and image reconstruction is performed based on the group of this interpolation data.
[0016]
The 1st bulb when an error arises during the scan of a bulb in this operation gestalt (bulb)
It is X about the error having occurred in the bulb 3-1, supposing the error occurred in X line part of 3-1.
The line control section 6 distinguishes from a status bit, and sends out a condition (status) bit to the CC section 12.
**. The status bit consists of a bit flag which shows the specific number of a bulb, and

the condition of a bulb. Inside

******** 12 investigates a status bit and is the roll control section 7 and light about the disable code of a bulb 3-1.

It sends out to the study system position control section 8. The roll control section 7 and the optical-system position control section 8 detect with a bulb 3-1.

A drive stop signal is sent to the rotation driving gear and migration equipment of a vessel 4-1. The CC section 12 is a bulb 3. -

It is the 1st to other bulbs by which current use is not carried out after checking that all motions of 1 have stopped.

The scan conditions of a bulb 3-1 etc. are used for delivery, and the bulb is used instead of a bulb 3-1.

[0017]

The effectiveness of this operation gestalt is explained below.

(**) A helical dynamic scan can be performed.

Helical scan is a method which scans analyte spirally, and can scan the large range quickly.

**. Moreover, if it is the scanned range, it is made to an image in every part. On the other hand, it is a dynamic scan.

Observing and photoing a change of a scan location with time by scanning a certain location continuously

It can do. And it is plurality as shown in drawing 3 (A) according to the CT scanner of this operation gestalt (drawing).

By three bulbs 31a-31c, when the helical scan of the range d is carried out, it is shown in this drawing (B).

like -- each location P1 - P4 A change of the image which can be set with time can be seen. Namely, a helicopter

A cull dynamics can becomes possible.

[0018]

Moreover, a difference image is created using a helical dynamic scan, and aging of a contrast medium is observed.

In case it carries out, as shown in drawing 4 , it is necessary to make equal the orbit of each bulbs 31a-31c.

About this, it sets up easily from the relation between spacing of Bulbs 31a-31c, and the feed rate of analyte.

** is possible. Moreover, it is a bulb 3 in order to decide after how many seconds the same part of analyte is scanned.

It can decide by whenever [spacing / of 1a-31c /, and champing-angle / of Bulbs 31a-31c]. Again

By shifting whenever [champing-angle / of Bulbs 31a-31c], as shown in drawing 5 , they are bulbs 31a-3.

Spacing h of 1c can be made narrower than the width of face of the bulb itself. That is, the radius of a bulb

If it does not attach whenever [champing-angle] in being 100 [mm], spacing of bulbs is at least 20.

0 [mm] Although needed, if whenever [champing-angle] is attached, it will come out to carry out this spacing to more than 0 [mm].

It cuts.

[0019]

And if such a helical dynamic scan is used, it shows in drawing 3 (c) and needs.

Cinedisplay 34 which met a change with time by the ** three-dimension image can be performed. This display is for example, the brain surgery field.

It comes out and effective use is expected.

[0020]

(**) On two or more photography conditions, the same range as the almost same time amount can be scanned.

For example, as shown in drawing 6 (A), it is the upper part about analyte (patient) 40 at 2 sets of optical system 41 and 42.

A top-bottom if it scans from a side face to coincidence, as shown in drawing 6 (B) (top-bot)

Obtaining the SUKYANO gram of a tom image and a light-left (right-left) image

It can do. Moreover, it is almost the same as coincidence in the scan to which the rotational speed of a beam or optical system was changed for every optical system.

It can carry out in the range. And the scan which is different from each other before a contrast medium is spilt out by this

It can scan on conditions. Moreover, it improves in a patient throughput and the burden to a patient mitigates.

It is carried out. And the time and effort rescanned when the time of wanting to change and scan conditions and photography go wrong

It can exclude. This is effective especially in the research which requires scanning on condition that versatility.

[0021]

(**) Two or more parts can be photoed on the scan conditions according to a part to

coincidence.

Two or more parts can be scanned on the scan conditions according to a part to coincidence. This is a mass screening etc.

It is more effective for a ** case. In this case, a bulb 51 scans a thorax in drawing 7 .

It can carry out and a bulb 52 can scan an abdomen. these scans -- coincidence -- moreover -- scan conditions -- it

Since it sets to the conditions according to ****** and can scan, an exact diagnosis can be performed, and the exposure of an X-ray is also ******.

It can hold down to small **, and moreover, a per capita scan time is short and ends.

[0022]

(**) Even when it becomes impossible to use a bulb in use, it can switch to other bulbs.

The key factor of the down time of conventional equipment is failure of a bulb. However, at this operation gestalt, it is tubing.

**** [use and] when the time of the capacity of a bulb filling and a bulb break down since there are two or more balls

It can be and a bulb can be used as a reserve. For this reason, the need of using all bulbs for coincidence

****** inspection can continue inspection using the bulb in which the thing which becomes impossible remained. Therefore, a bulb

There is no down time by ****** and it can always respond to an urgent inspection.

[0023]

(**) The fixed range can be scanned conventionally in a short time.

Drawing 8 (A) shows the conventional helical scan which performs a spiral scan by one bulb, and is this place.

1 time of the scan time of ** is set to t. On the other hand, drawing 8 (B) is the same part at two bulbs by this invention.

The case where it scans is shown and 1 time of the scan time in this case is set to 1/2t. Thus, this invention

When it is alike and scans by n optical system more, a photograph can be taken by the time amount of the conventional 1/n. This

It is effective by the time of having to scan in a short time like [when ******** is poured in], and **.

**.

[0024]

(**) Spatial resolving power can be raised.

When photoing a homotype enclosure within a certain fixed time amount, since a

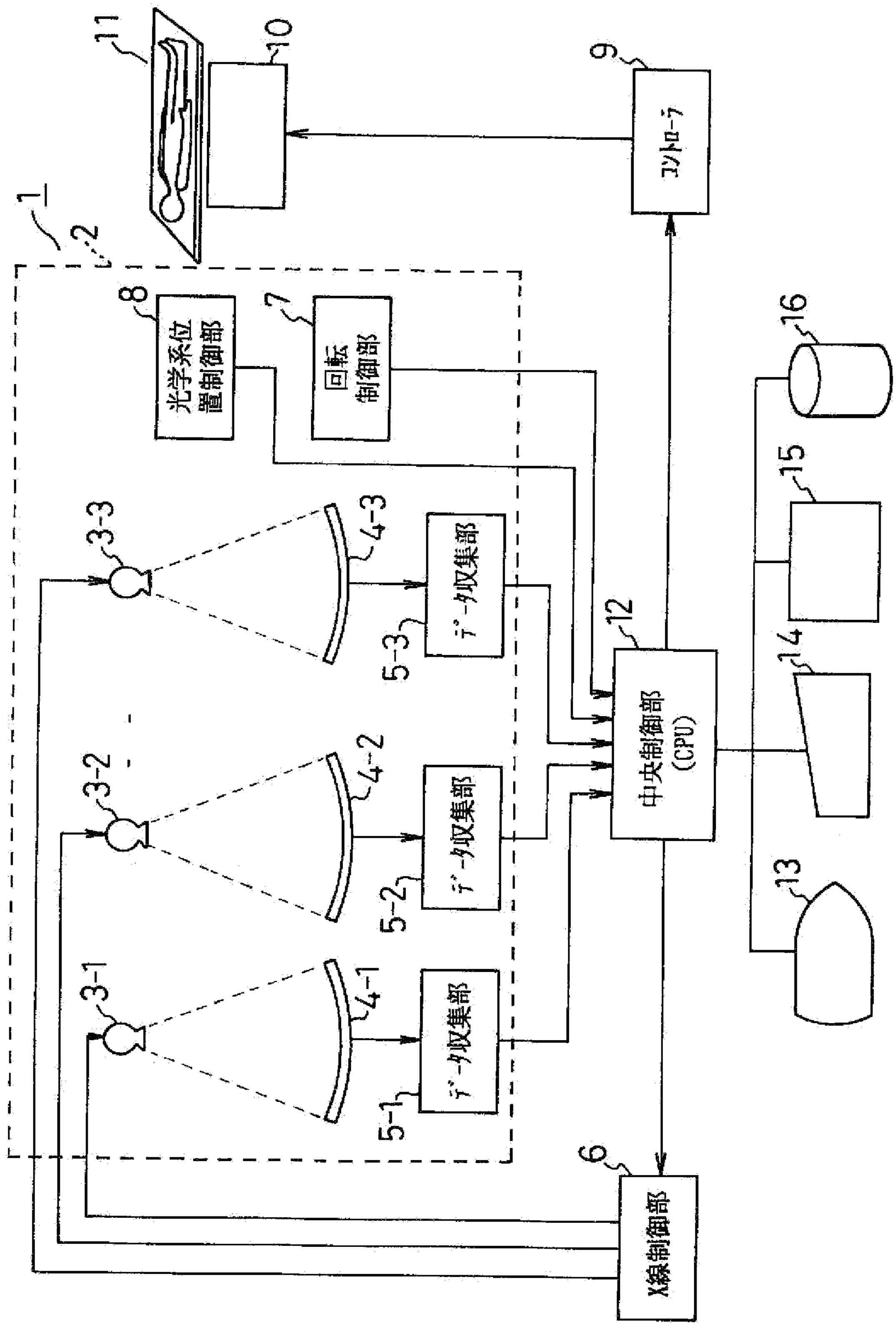
photograph is taken by two or more optical system, a scan comes out densely.
The spatial resolving power of the direction which came and met the body axis can be raised.
[0025]
(g) A dual energy scan can be performed.
If the energy of the X-ray which is different from each other by two or more bulbs is made to use it, it will be a dual energy easily.
A scan becomes possible.
[0026]
That is, it is each by photoing the same part with two or more kinds of X lineal energies. The image for every energy is obtained. These images are used and they are an electron distribution consistency and Compton scattering.
It can ask for the image showing a ** grade and the photoelectric effect by count. These are under a photographic subject.
base -- it becomes useful information when presuming a presentation. They are the reinforcement of Compton scattering, and the photoelectric effect for every element.
Since strong ratios differ, X-ray absorption is decided by the consistency of these two scattering effects and the matter.
It comes out.
[0027]
In addition, it is not limited to the above-mentioned operation gestalt, and this operation gestalt is the drawing 10 (A) ****.
** -- you may scan by installing the gantries 65-67 of plurality (drawing three pieces) like. **
** -- although spacing of each X-ray tube cannot be narrowed to some extent below with a configuration [like] -- drawing 10
As shown in (B), the tilt of each gantries 65-67 can be carried out.
[Brief Description of the Drawings]
[0028]
[Drawing 1] The conceptual diagram of the X-ray CT scanner which is 1 operation gestalt of a CT scanner based on this invention.
[Drawing 2] An example of the block diagram of the control section in the operation gestalt of drawing 1 and a scan condition list is shown.
[Drawing 3]A partial diagrammatic view A shows an example of a helical dynamic scan, a partial diagrammatic view B shows two or more head images photoed with time by the helical dynamic scan, and a partial diagrammatic view C shows the example of the

cinedisplay which met aging by the three-dimension image with a helical dynamic scan.
[Drawing 4] The example which doubled the bulb with the spiral orbit of helical scan is shown.
[Drawing 5] The example which shifted whenever [champing-angle / of each bulb] is shown.
[Drawing 6]Partial diagrammatic views A are two or more photography conditions, the example which scanned the same range as the almost same time amount is shown, and a partial diagrammatic view B shows the image obtained as a result.
[Drawing 7] The example which scanned other parts on the scan conditions according to a part to coincidence is shown.
[Drawing 8]a partial diagrammatic view A shows the helical scan since ** which performs a spiral scan by one bulb, and a partial diagrammatic view B shows the case where the same part is scanned by two bulbs by this invention.
[Drawing 9]A partial diagrammatic view A is a perspective view showing the example of the scan by the conventional helical scan CT scanner, a partial diagrammatic view B is a side elevation, and a partial diagrammatic view C is drawing foreseen from the stand.
[Drawing 10] The example photoed using two or more gantries is shown.
[Description of Notations]
[0029]
1 X-ray CT Scanner (CT Scanner)
2 Stand
3-1, 3-2, 3-3 Bulb
4-1, 4-2, 4-3 Detector
11 Berth
10 Berth Mechanical Component
12 Control Section

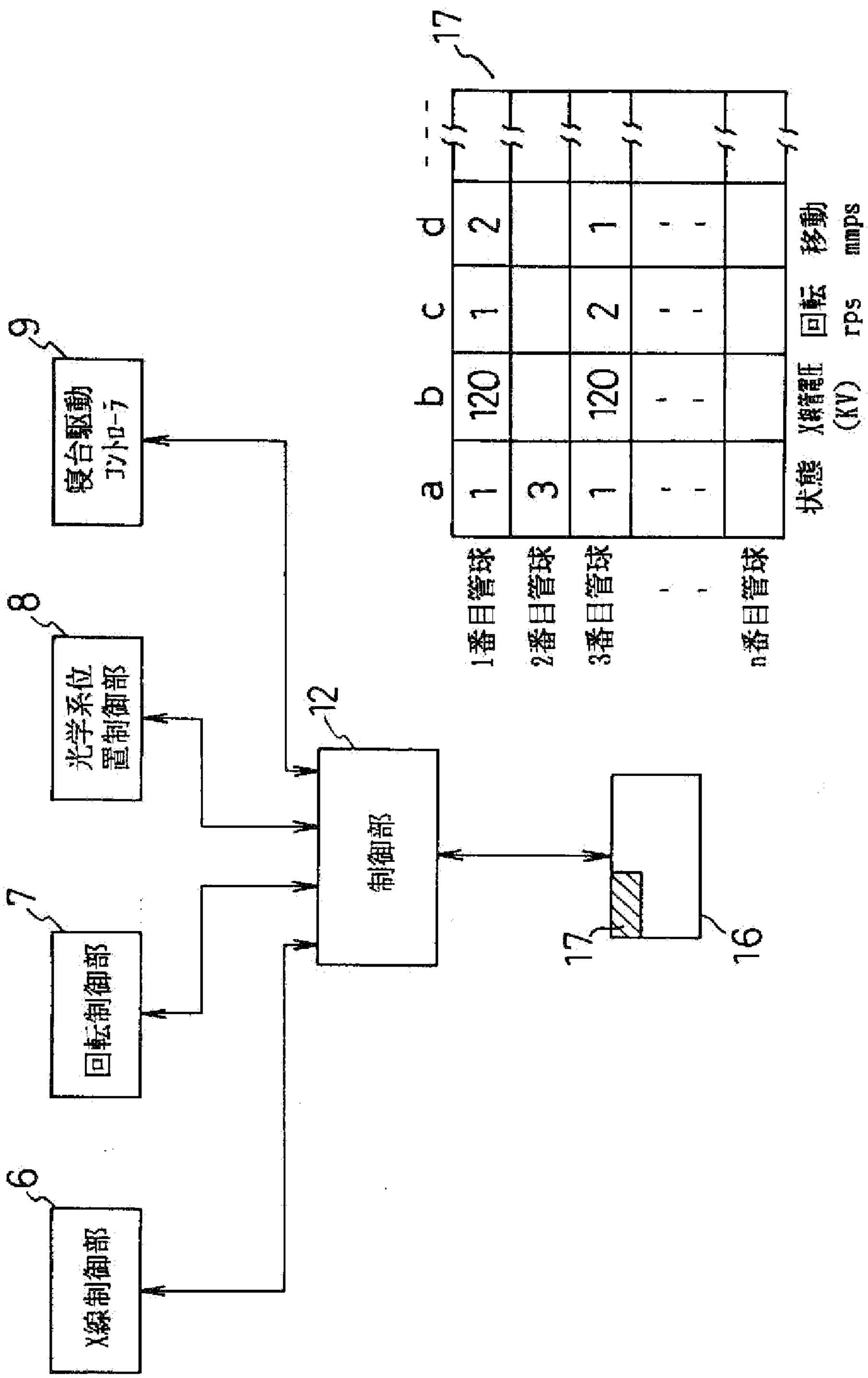
[Translation done.]

DRAWINGS

[Drawing 1]

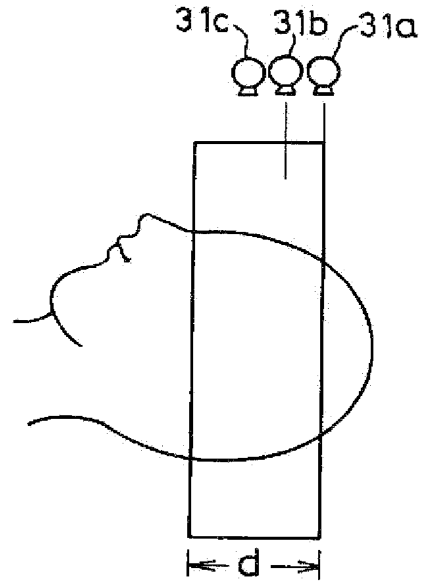

1
2
光学系位置制御部
8
回転制御部
7
コントローラ
9
10
11
3-1
3-2
3-3
4-1
4-2
4-3
データ収集部
5-1
データ収集部
5-2
データ収集部
5-3
中央制御部
(CPU)
12
X線制御部
6
13
14
15
16

[Drawing 2]

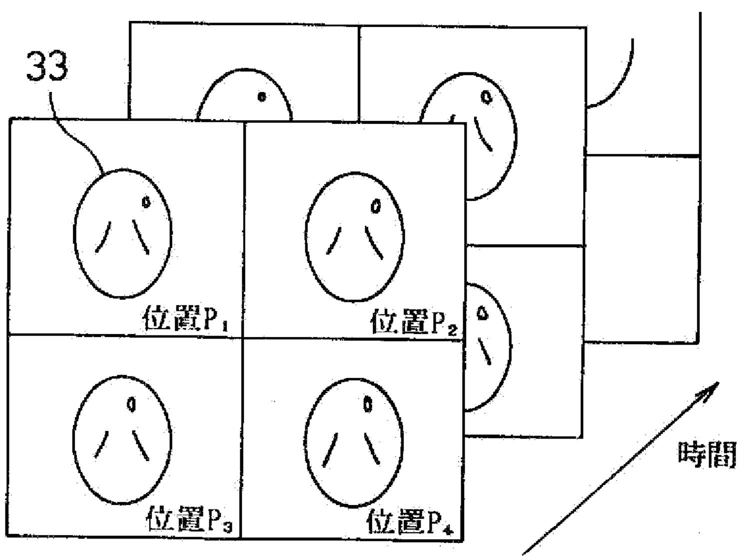

X線制御部
6
回転制御部
7
光学系位置制御部
8
寝台駆動コントローラ
9
制御部
12
16
17
a
b
c
d
1番目管球 1 120 1 2
2番目管球 3
3番目管球 1 120 2 1
n番目管球
状態
X線管電圧 (KV)
回転 rps
移動 mmps

[Drawing 3]

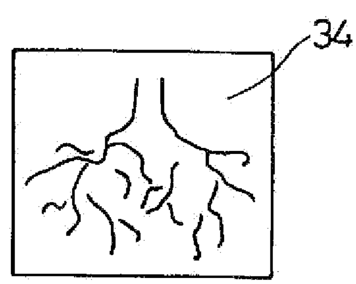
(A)



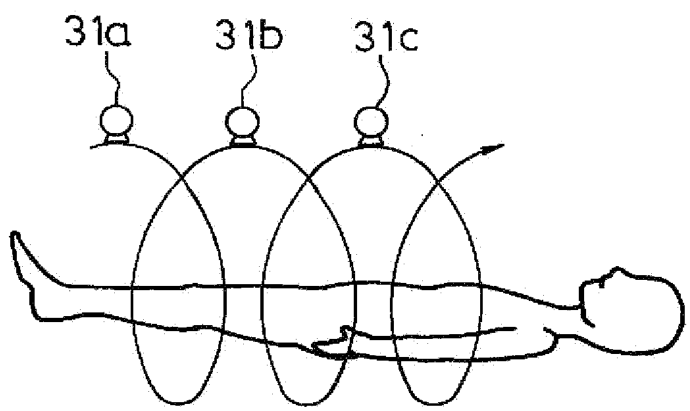
(B)



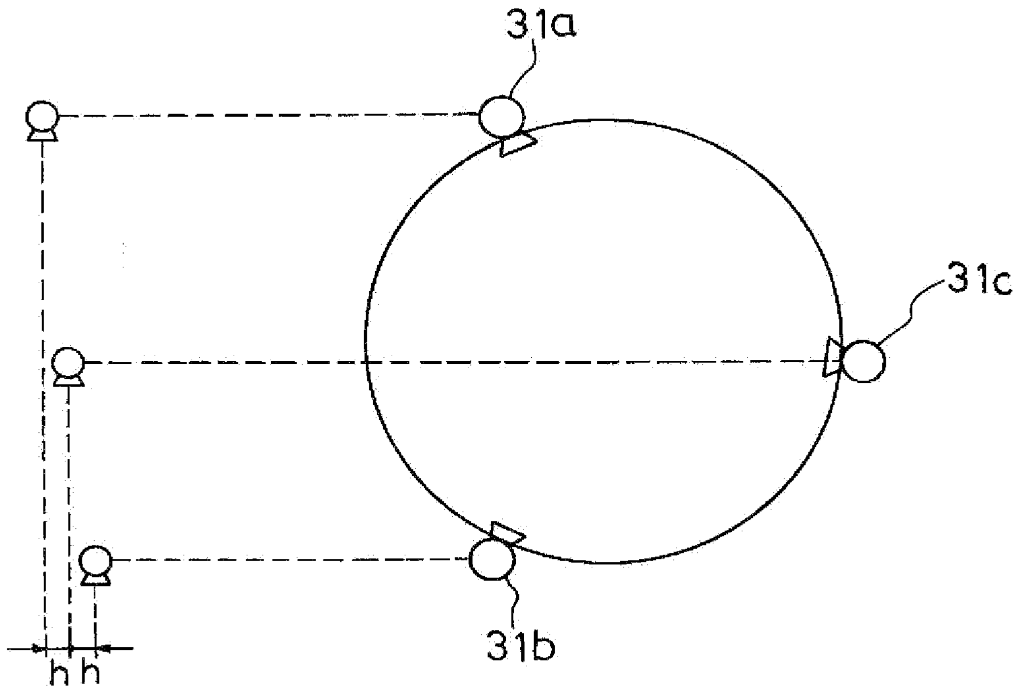
(C)



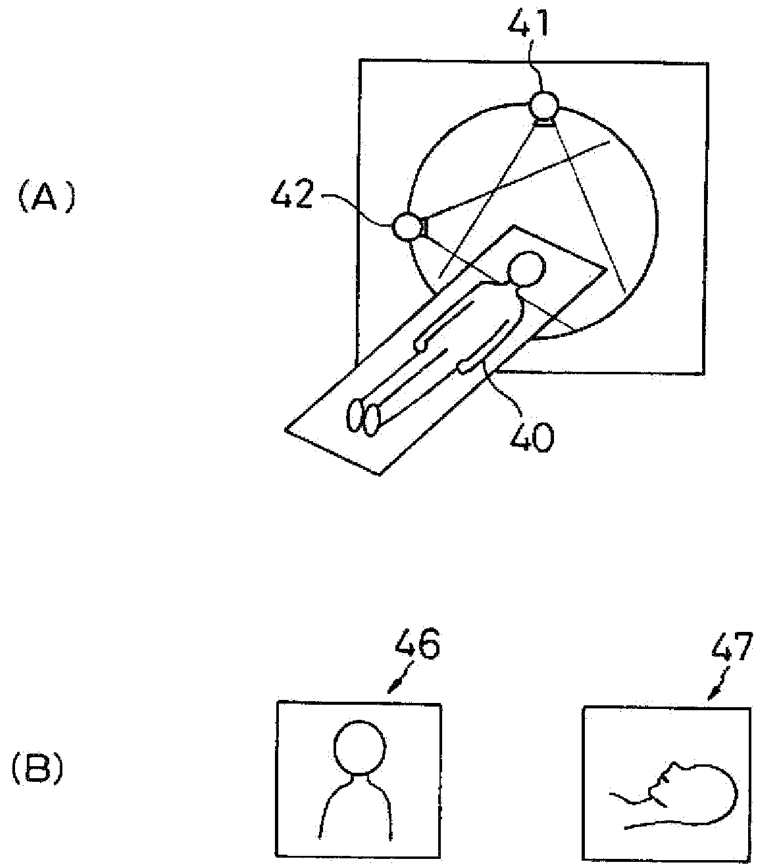
[Drawing 4]



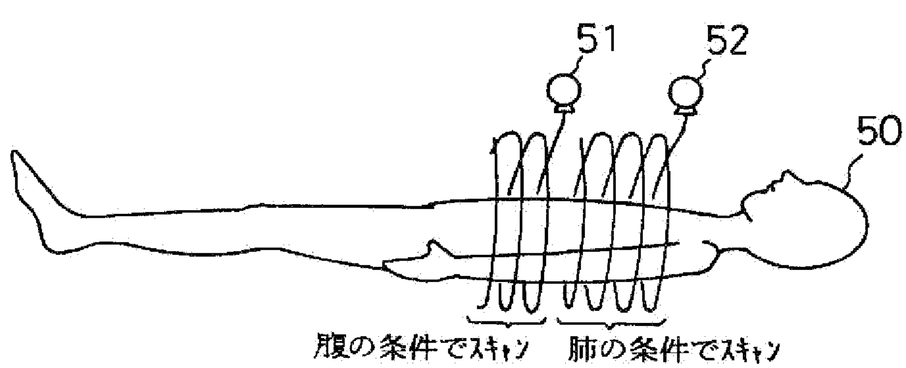
[Drawing 5]



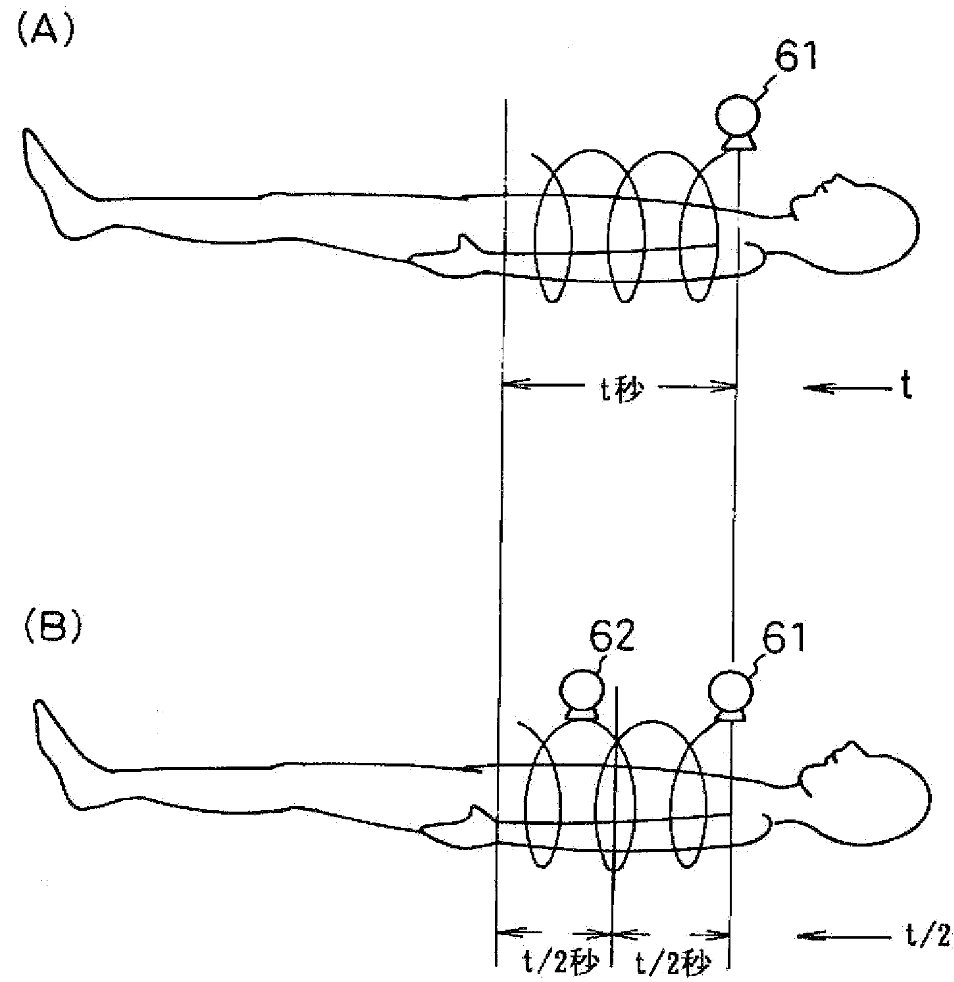
[Drawing 6]



[Drawing 7]

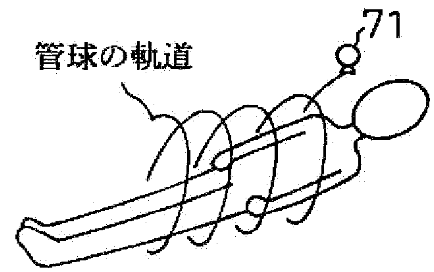


[Drawing 8]

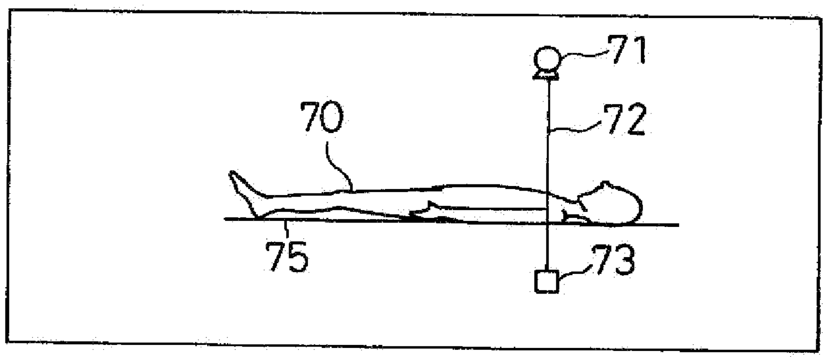

(A)
61
t秒
t
(B)
62
61
t/2秒
t/2秒
t/2

[Drawing 9]

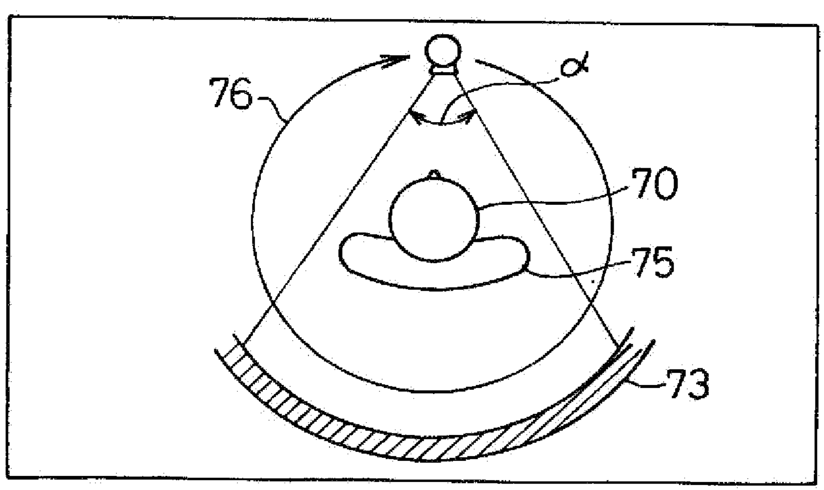
(A)



(B)

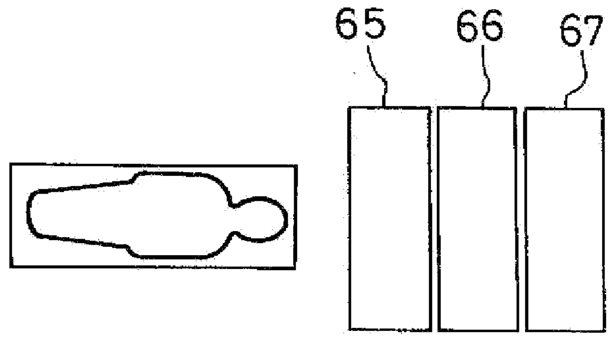


(C)

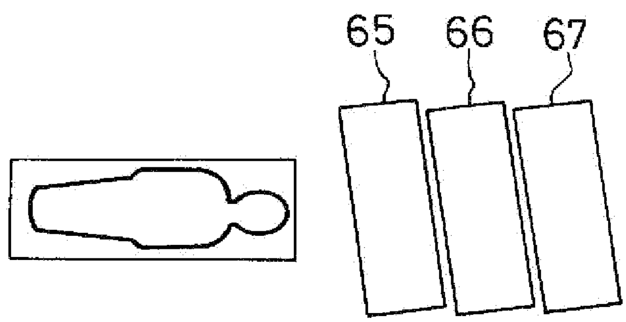


[Drawing 10]

(A)



(B)



[Translation done.]